

## **DETAILED ACTION**

1. Claims 1-7, 10-11, 13, and 15-33 are presented for examination, wherein claims 1, 10-11, 13, and 15-16 are currently amended; and, claims 26-33 are withdrawn. Claims 8-9, 12, 14, and 34 are cancelled.
2. The 35 USC § 112 ¶2 rejection of claim 34 is withdrawn as a result of the cancellation of said claim.
3. The 35 USC §§ 102(b) and 103(a) rejections of claims 8-9, 12, 14, and 34 are withdrawn as a result of the cancellation of said claims.

### ***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
5. Claims **1-7, 10-11, 13, and 15-25** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

More specifically, in claim 1, from which the other claims depend, the term “substantially” does not have adequate guidance in the specification to determine the metes and bounds of the limitation.

### ***Claim Rejections - 35 USC § 102(b)***

6. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
7. Claims 1-5, 10, 13, 18 and 20 are rejected under 35 U.S.C. 102(b) as anticipated by over Horvath et al (US 3,876,749).

a. Regarding claim 1, Horvath teaches a method for reducing the red mud byproduct (abstract and 3:66-67, which includes aluminaferrous and titaniferrous mixtures) of the Bayer process of aluminum manufacturing, recovering aluminate (abstract) comprising: (A) smelting the mixture in the presence of a reducing agent to produce a molten slag (3:37-47), whereby substantially the whole of the iron present in the titaniferrous or aluminaferrous mixture is reduced to molten metallic iron in the molten slag (3:45-37, wherein 80-90% of iron oxide in the red mud is converted to metallic iron), wherein the molten metallic iron is steel (3:56); (B) adding burnt lime to the slag (1:53, an alkali); (C) isolating molten iron from the molten slag to produce a residual slag (3:56-58); and (D) recovering the metal oxide from the residual slag (3:64-4:57, more particularly 4:55-57, wherein the slag is separated and further treated and ultimately recycled back into the Bayer process to form alumina, a metal oxide).

Horvath does not expressly teach in step (A) that "the reducing agent comprises molten cast iron." However, cast iron has 2.1 wt.% to 4 wt.% C, while steel has 0.5 to 2.1 wt.% C. So, molten iron does not exclude cast iron.

In the alternative, the "cast" limitation of "molten cast iron bath" does not patentably distinguish molten iron, since the molten cast iron bath is a product by process limitation--i.e. the process of making a molten iron bath is by casting the iron.

The limitation labeling the molten cast iron as a reducing agent does not patentably distinguish the instant invention from the prior art.

b. Regarding claim 2, Horvath teaches the method of claim 1, wherein the titaniferrous mixture is optional. Therefore, this claim is met since Horvath teaches the

aluminaferrous mixture of claim 1 (see *supra*). In the alternative, aluminum is formed from bauxite using the Bayer process (1:10-11) and the red mud byproduct is refined (1:46-47) and reintroduced into the Bayer process (5:54-55). Moreover, Perovskite is formed during the process (3:28), of which at least some would be reintroduced into the Bayer process, and would be part of the titaniferrous mixture from which at least one metal oxide would be recovered.

- c. Regarding claim **3-4**, Horvath teaches the method of claim 1, wherein the aluminaferrous mixture is bauxite (1:11, an aluminum ore) or red mud (1:46-47).
- d. Regarding claims **5**, Horvath teaches the method of claim 1, wherein Horvath teaches recovering alumina in the final form of aluminum (4:54-57, wherein aluminate liquor are reintroduced into the Bayer process, which ultimately forms aluminum) and  $Fe_2O_3$ , which is ultimately recovered as steel (3:66, wherein  $Fe_2O_3$  must be formed or the molar ratio would be meaningless, 3:46-47, wherein if 80-90% of iron oxide is converted to iron, then 10-20% of iron oxide remains in the slag, and 3:55-57, wherein at least some of the iron oxide will be reintroduced into the Bayer process).
- e. Regarding claims **10** Horvath teaches the method of claim 1, wherein step (A) includes molten iron in the bath, which is ultimately recovered as steel, but does not expressly teach the “cast” limitation of “molten cast iron bath.” However, cast iron has 2.1 wt.% to 4 wt.% C, while steel has 0.5 to 2.1 wt.% C. So, the molten iron does not exclude cast iron.

*In the alternative*, the “cast” limitation of “molten cast iron bath” does not patentably distinguish molten iron, since the molten cast iron bath is a product by process limitation--i.e. the process of making a molten iron bath is by casting the iron.

f. Regarding claim **13**, Horvath teaches the method of claim 1, wherein step (A) comprises smelting the mixture in the presence of reducing agent (3:38-39) and lime (1:47-52).

g. Regarding claim **18**, Horvath teaches the method of claim 1, wherein in step (C), the molten iron and residual slag are tapped separately (3:55-57).

h. Regarding claim **20**, Horvath teaches the method of claim 1, wherein step (D) comprises: (D1) adding to the residual slag an aqueous solution ( 4:13-15); (D2) separating a metallate solution from a metallate residue (4:15, filtration); and (D3) isolating the metal oxide from the metallate solution and/or from the metallate residue (4:16-17, wherein metal oxide will be separated).

8. Claims 11 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Horvath et al (US 3,876,749).

i. Regarding claim **11**, Horvath teaches the method of claim 1 as provided *supra*, wherein molten steel is taught (e.g. abstract), but does not expressly teach “the metallic iron is 0.8 to 1.0% C steel.” However, steel has known carbon content which includes the instantly claimed carbon content. MPEP § 2144.05(I).

*In the alternative*, since Horvath discloses substantially the same composition made by substantially the same process (i.e. recovery of steel from molten red mud by

adding a reducing agent and burnt lime), the resulting steel being “0.8 to 1.0% C steel” would be expected. MPEP § 2112.01(I).

j. Regarding claim 19, Horvath teaches the method of claim 18 as provided *supra*, but does not expressly teach “during tapping of residual slag, alkali is added by dosing.” However, a person of ordinary skill in the art would understand that adding the alkali in doses, rather than all at once may lead to reduced costs and improved uniformity of the reaction. As a result, it would have been obvious to a person of ordinary skill at the time of the invention to add the alkali in the Horvath method by doses, in order to potentially reduce costs and improve uniformity of the reaction.

9. Claims 1, 6-7, 11, 15-17, and 19-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Horvath et al (US 3,876,749) in view of Jha (WO 02/10068).

k. *Claim 1 is being rejected in the alternative in order to address dependent claims 6-7, 14-17, 20-25 and 34.* Horvath is applied to claim 1 for the same reasons as provided *supra*, with the following modifications.

*In the alternative for step (D),* Horvath teaches the Bayer process can be performed either by heating the bauxite with concentrated caustic soda or by melting (1:10-14). Harvath teaches after separating the steel and molten slag (3:54-56), to chemically and mechanically treat the slag to form a slurry (3:3:57-4:12) to form as slurry, which is leached, washed and filtered (4:6-15), wherein the solution contains aluminate (4:55).

Jha teaches recovering alumina from bauxite ore using the Bayer’s process through the use of caustic soda (Figure 11 and 2: 6-14, wherein NaOH is also known as

caustic soda) and further explains that complete recovery of alumina is not economically possible by the Bayer process (2:13-15). The solid filter residue byproduct of the Bayer process, known as “red mud,” is a substantial environmental hazard (3:2-8). Jha teaches a method of recovering residual alumina at 98% efficiency and titanium dioxide from the red mud byproduct (4:8-10 and 8:24-29). As a result, it would have been obvious to a person of ordinary skill at the time of the invention to treat the slurry of Horvath in the manner taught by Jha in order to extract the residual alumina at 98% efficiency and titanium dioxide from the residual byproduct, as taught by Jha (8:24-29).

- l. Regarding claims **6**, Horvath as modified teaches the method of claim 1, wherein Jha teaches the precipitation of aluminum hydroxide is an intermediate product of extracting residual alumina from the aluminate byproduct (9:7-12).
- m. Regarding claims **7** Horvath as modified teaches the method of claim 1, wherein Jha teaches “the at least one metal oxide is at least two metal oxides being  $TiO_2$  and  $Al_2O_3$ ” (8:24-29).
- n. *In the alternative* regarding claim **11**, Horvath as modified teaches the method of claim 9 as provided *supra*, wherein Horvath teaches a steel melt is taught, but does not expressly teach “the metallic iron is 0.8 to 1.0% C steel.” However, since Horvath discloses substantially the same composition made by substantially the same process (i.e. recovery of steel from molten red mud by adding a reducing agent and burnt lime), the resulting steel being “0.8 to 1.0% C steel” would be expected. MPEP § 2112.01(I).
- o. Regarding claims **15-16**, Horvath as modified teaches the method of claim 1, wherein Jha teaches roasting the byproduct with sodium carbonate in air (8-10).

p. Regarding claim 17, Horvath teaches the method of claim 1 as provided *supra*, wherein step (A) comprises smelting the mixture in alkali (7:5, burnt lime) and in the presence of up to 50% by stoichiometric proportion (1:50, wherein burnt lime is mixed in 0.4-1.5 wt% of slag, which overlaps the instantly claimed range of up to 50 wt% of mixture), but does not expressly teach the “titaniferous mixture is ilmenite.” However, a titaniferous mixture is merely optional in claim 1, therefore is ilmenite is not required in claim 17.

In addition, the examiner takes official notice that ilmenite and bauxite naturally occur together, so the bauxite of claim 1 would be expected to include some ilmenite and treatment of bauxite would be expected to result in treatment of ilmenite.

q. *In the alternative* regarding claim 19, Horvath as modified teaches the method of claim 18, but does not expressly teach “during tapping of residual slag, alkali is added by dosing.” However, a person of ordinary skill in the art would understand that adding the alkali in doses, rather than all at once may lead to reduced costs and improved uniformity of the reaction. As a result, it would have been obvious to a person of ordinary skill at the time of the invention to add the alkali in the Horvath method by doses, in order to potentially reduce costs and improve uniformity of the reaction.

r. *In the alternative* regarding claim 20, Horvath as modified teaches the method of claim 1, wherein Horvath teaches the method of claim 1, wherein step (D) comprises: (D1) adding to the residual slag an aqueous solution (4:13-15); (D2) separating a metallate solution from a metallate residue (4:15, filtration), as provided *supra*. However,

in the alternative, Jha teaches (D3) isolating the metal oxide from the metallate solution and/or from the metallate residue (Figure 11).

s. Regarding claim 21, Horvath as modified teaches the method of claim 20, wherein Jha teaches step (D3a) precipitating metal hydroxide from the metallate solution (9:7-12).

t. Regarding claim 22, Horvath as modified teaches the method of claim 21, wherein Jha teaches step (D3a) includes: bubbling CO<sub>2</sub> gas through the metallate solution (9:7-12).

u. Regarding claim 23, Horvath as modified teaches the method of claim 22, wherein Jha teaches CO<sub>2</sub> gas is generated during step (A) (7:5).

v. Regarding claim 24, Horvath as modified teaches the method of claim 20, wherein Jha teaches step (D3) comprises: (D3b) acid leaching the metallate residue to produce an acid leachate; (D3c) selectively precipitating from the acid leachate a hydrated salt of the metal oxide; and (D3d) converting the hydrated salt into the metal oxide (10:27-31).

w. Regarding claim 25, Horvath as modified teaches the method of claim 24, wherein Jha teaches in step (D3b): (D3b1) acidifying the metallate residue to produce a slurry (11:4-5); (D3b2) hydrolyzing the slurry (11:7); and (D3b3) separating the metallate solution from an insoluble residue (11:11-12).

#### ***Response to Arguments***

10. Applicant's arguments filed July 5, 2011 have been fully considered but they are not persuasive.

11. Regarding the U.S.C. § 102(b) rejection over Horvath, the applicants make the following arguments.

x. First, the applicants argue the term “cast” in “cast iron” is a limitation of composition, rather than that of processing.

In response, the examiner respectfully notes that cast iron has 2.1 wt.% to 4 wt.% C, while steel has 0.5 to 2.1 wt.% C. So, molten iron does not exclude cast iron.

Furthermore, the term is used in at least two ways, one processing and the other in composition. A term is read in the broadest reasonable manner in light of the specification. Upon review of the specification, the examiner concludes that the term may be read either as a process or as a composition.

The specification indicates it is the presence of carbon and silicon that is critical, not necessarily a higher concentration of carbon and silicon, which may be found in cast iron. The specification does not indicate the concentration of carbon and silicon at 2.1-4% and 1-3% to be critical.

y. Second, the applicants argue Horvath does not teach using cast iron as a reducing agent.

In response, the examiner respectfully notes the label of “reducing agent” does not patentably distinguish the instant invention from the prior art.

12. Regarding the 35 U.S.C. § 103(a) rejection over Horvath, the applicants argue Horvath cannot be construed to teach the recovery of steel from molten red mud.

In response, the examiner respectfully notes that the arguments of counsel cannot take the place of factually supported objective evidence. MPEP § 2145.

13. Regarding the 35 U.S.C. § 103(a) rejection over Horvath in view of Jha, the applicants make the following arguments.

z. First, the applicants argue Horvath cannot be construed to teach the recovery of steel with 0.8-1.0% carbon from molten red mud.

In response, the examiner respectfully notes Horvath teaches molten steel is formed. Steel has known carbon content which includes the instant claimed carbon content.

aa. Second, the applicants argue the combination of Horvath and Jha is improper.

In response, the examiner respectfully notes that the method of Jha is used as a subsequent step (D) to Horvath's steps (A) through (C), as provided in the prior Office action, in order "to further extract the residual alumina at 98% efficiency and titanium dioxide from the residual byproduct."

### ***Conclusion***

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to YOSHITOSHI TAKEUCHI whose telephone number is (571)270-5828. The examiner can normally be reached on Monday-Thursday 9:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jessica L. Ward can be reached on 571-272-1223. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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